

4-1-2019

Social class inequalities in tooth-brushing time: The role of material, behavioral, psychosocial, and workplace environmental factors among the South Korean population

Herry Novrinda

Department of Preventive and Social Dentistry, Seoul National University School of Dentistry, Korea

Dong-Hun Han

Department of Preventive and Social Dentistry, Seoul National University School of Dentistry, Korea,
dhhan73@snu.ac.kr

Peter Andreas

Department of Dental Public Health and Preventive Dentistry, Universitas Indonesia, Indonesia

Follow this and additional works at: <https://scholarhub.ui.ac.id/mjhr>



Part of the [Medicine and Health Sciences Commons](#)

Recommended Citation

Novrinda H, Han D, Andreas P. Social class inequalities in tooth-brushing time: The role of material, behavioral, psychosocial, and workplace environmental factors among the South Korean population. *Makara J Health Res.* 2019;23.

Social class inequalities in tooth-brushing time: The role of material, behavioral, psychosocial, and workplace environmental factors among the South Korean population

Herry Novrinda^{1,3}, Dong-Hun Han^{1,2*}, Peter Andreas³

1. Department of Preventive and Social Dentistry, Seoul National University School of Dentistry, Seoul 08826, Korea
2. Dental Research Institute, Seoul National University, Seoul 08826, Korea
3. Department of Dental Public Health and Preventive Dentistry, Universitas Indonesia, Jakarta 10430, Indonesia

*E-mail: dhhan73@snu.ac.kr

Abstract

Background: Inequality in health should be prevented. The aims of this study were to assess inequalities prevalent in tooth-brushing after lunch (TAL) and in tooth-brushing before sleep (TBS) among Koreans using the NMSC indicator and to assess the role of material, health behavioral, psychosocial, and workplace environmental (WPE) determinants in associating the indicator with tooth brushing activities. **Methods:** The data were from the 4th KNHANES with 6,710 workers and entrepreneurs from 19 to 54 year old, who were grouped into 12 social class positions. TAL and TBS were the outcomes. Data analysis was performed using a logistic regression sequence. The results were reported as OR and 95% CI. **Results:** The proportion of owner groups was higher for TBS than for TAL, whereas that of worker groups was higher for TAL than for TBS. The highest probability was shown by expert workers (TAL) and capitalists (TBS) among various models. WPE factors had the highest explanatory power for both. **Conclusions:** Non-gradient social class disparities related to tooth brushing were recognized for the Korean adults. The behavior of brushing teeth at two different times revealed a different pattern of social inequality regarding oral health. Thus, workplace-based oral health promotion programs should be implemented.

Keywords: behavior, health status disparities, poverty, toothbrushing

Introduction

Socioeconomic inequality - related oral health behavior is a known occurrence that should be avoided or reduced. Several studies have been reported regarding that issues. For instance, a study have reported that the absolute social inequality in tooth brushing increase from 1991–2014.¹ In addition, a research have shown that there is an increasing trend in the prevalence of tooth brushing according to socio-economic position in Iran.²

Elaborating on the relationship between social class and oral health behavior, particularly regarding tooth brushing behavior and the responsibilities of mediating factors, is expected to have essential benefits at the level of health policy and application. Education, occupation, and income were often used as socioeconomic measurement, whereas only a small number of studies have initiated the Neo-Marxist conception to elaborate social class inequalities related to general and oral health.^{3,4}

For more than 2 decades now, the class scheme developed by Erik Olin Wright was the most “standardized” and often-applied indicator to understand

the occurrence of health inequalities. A number of study reviewed 19 health-related publications from various countries since 1994 until 2015 using the "Neo-Marxist Literature" with their conceptual definitions used. A total of 11 out 19 studies used "Wright's social class locations". The Wright scheme combines the central mechanisms of social class (i.e., ownership/property and managerial control/relationship) and credentialism into 12 non-ordinal combinations.^{3,5}

Thus, a simple theoretical framework was organized (Figure 1) to propose four possible mediating determinants for elaborating on the social class inequalities involved in tooth brushing after lunch (TAL) and in tooth brushing before sleep (TBS): material, behavioral, psychosocial, and workplace environment.^{1,4,6-8} This study analyzed whether the social class inequalities according to Wright's social class maps for TAL and TBS might be apparent in the South Korean population. Moreover, we presumed that the WPE and material factors have more significant role for explanation of the social class inequalities. Therefore, the aims of study were (1) assessing the role of various socioeconomic position indicators for TAL and TBS among Korean individuals

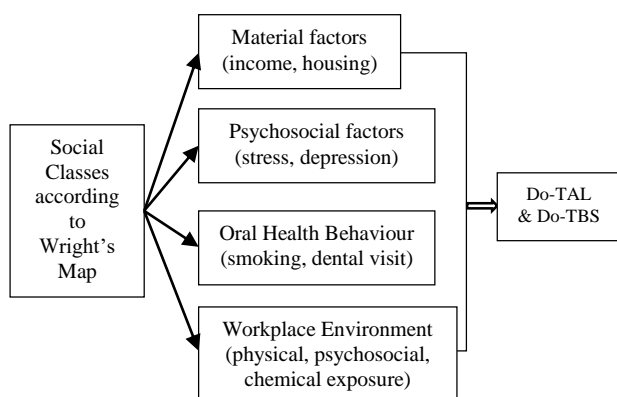


Figure 1. Theoretical framework elaborating on the multiple factors associated with social class inequalities in tooth brushing activity.

using the social class indicator proposed by Erik Olin Wright and (2) assessing the impact of multiple factors (M, HB, PS & WPE) as the mediating determinants for the relationship between social classes and TAL/TBS.

Methods

The Korea National Health and Nutrition Examination Survey 2007-2009 was used in this study. The KNHANES IV was a nationally representative cross-sectional survey conducted by the Korean Centers for Disease Control and Prevention⁹ for choosing respondents as a representation of the civilian and non-institutionalized Korean individuals. The respondents in this study were 6,710 workers and entrepreneurs from 19 to 54 year old, excluding housewives, scholars, retired individuals, jobless individuals, military staff, and informal family members.⁴

The Neo-Marxian social class (NMSC) variable comes from various variables in the KNHANES namely, occupational status, number of employees, supervision status, an official working categorization in Republic of Korea (KSCO), and highest level of education attainment. A question was administered for every variable, following which the above-mentioned personal data were merged and categorized according to each individual's NMSC variable. The respondents were categorized into 12 groups according to the NMSC and in accordance to whether they were self-employed to represent the relation to means of production in the property dimension.

The property owners were self-employed respondents. There were three categories of the owners: capitalists, small employers, and petty bourgeoisie. The capitalists were respondents who employed ≥ 10 workers (informal family members not included). The respondents who were entrepreneurs and had 1–9 employees were categorized as small employers and the respondents who

did not have any employees except informal family members categorized as petty bourgeoisie.

The organizational and skill dimension for employees were combined and grouped into nine social classes. The organizational dimension of a respondent was based on whether he/she was the supervisor or supervised in the workplace and the job type according to KSCO. Managers in the organizational dimension included respondents who were supervisor to the other employees and whose position according to KSCO were managers. Supervisors were respondents who supervised other employees and held job position other than managers. Workers were respondents who were being supervised by other superiors

The skill dimension of a respondent depended upon job position according to KSCO and the level of education. The respondents who had received education at tertiary institutions and were employed as managers or professionals were grouped as experts. The respondents who were employed as managers or professionals and had received education at high schools or lower institutions as well as those who were employed at clerical positions or with craft and related trades who had received tertiary education were grouped as skilled workers. The respondents who were not included into expert or skilled categories were grouped as non-skilled workers. The outcomes for this study were TAL and TBS. We used a "Yes/No" question format for TAL and TBS measurements.

Income and house ownership were the components of the M factors. The components of the PS factors included stress perception that was determined by a question regarding sense of unhappiness or hopelessness that participants had experienced for minimum 2 weeks throughout the past year and whether the participants experienced a subjective event of depression. The components of HB factors were smoking and oral examination in the past year.

The physical and psychosocial as well as chemical exposure at the working place were the WPE factors. The physical factors encompassed cleanliness in the workplace, probability of accident, working in an uncomfortable position for a long duration, and lifting heavy objects. The psychosocial factors encompassed disproportion of work-time, decision authority, respect / trust, and hiding any feelings at workplace. The chemical exposure encompassed harmful chemicals, air impurities, risky tool, and noisy environment. Each WPE determinant was categorized into "Very Good," "Good," "Bad," and "Very Bad." The mentioned determinants were regarded as possible mediators for revealing of social classes inequalities regarding tooth brushing activity.

Statistical analysis. The characteristics of respondents as well as the frequency distributions for each categorical

variable were shown by TAL and TBS. For assessing the associations of TAL and TBS with categorical variables, chi-square test was performed. An approach using mediation analyses was performed¹⁰ to estimate the odds ratios (ORs) of TAL and TBS according to the Wright's social class. Data analysis was performed using a logistic regression sequence. Variables such as age and gender, M, PS, HB, and WPE were adjusted to the models. Non-skilled workers served as the reference group, and the age and gender were adjusted in the baseline-model.

Results

Table 1 shows the distribution of study participants in (TAL) and (TBS) according to gender and NMSC. The majority of the respondents were women and non-skilled workers of the NMSC with significant differences. In general, non-skilled groups and petty bourgeoisie formed lower proportion in TAL and TBS than other social classes. The proportion of owner groups (i.e., capitalist, small employers, and petty bourgeoisie) was higher in TBS than in TAL, while the proportion of worker groups (i.e., manager–non-skilled worker) was higher in TAL than in TBS.

Focusing on the working group, the proportion of the expert and skilled groups for TAL and TBS were found to be >67% and 47%, respectively, while that of the non-skilled groups were the lowest. Table 2 presents the distribution of the TAL and TBS according to potential mediating factors among the South Korean population. The low (I & II) income groups showed lower percent, while the high (III & IV) income groups showed higher percent with significant differences among the groups for TAL and TBS. House ownership revealed that the percent for all was higher in the “owner” groups than in the “no house” group with significant differences in TAL and insignificant difference in TBS. The “never smoking”

group formed the largest proportion in TAL and TBS with significant differences among the groups.

The “No stress” group was larger than the “stress” group with significant differences only in TBS while significant differences in TAL were found between the “no depression” and the “depression” group. The “very good and good” groups in WPE physical were larger than “bad and very bad” with significant differences among the groups for TAL and TBS. For WPE psychosocial, the “very good and good” groups were smaller than the “bad and very bad” groups, with significant differences in TBS. For WPE chemical exposure, the “very good and good” groups were larger than the “bad and very bad” groups, with significant differences among the groups for TAL and TBS.

Table 3 presents the ORs of every NMSC and the power of explanation of the mediating factors elaborating on the relationship between the NMSC and TAL. Expert workers showed significantly the highest probability of TAL as compared to the other social class in the different models (OR = 3.67, 3.15, 3.33, 3.66, and 2.94 in models 1–5, respectively), followed by skilled workers (OR = 3.20, 2.81, 2.99, 3.18, and 2.48 in models 1–5, respectively). Among the worker groups, the ORs of non-skilled workers were lower than those of other groups, even after adjusting for the mediating factors. The WPE factors showed the highest explanatory power for all group positions, followed by the M factor, except for non-skilled supervisors (OHB factor).

Explaining the role of mediating factors, in model 2; income, housing, smoking, and regular dental visit in model 3; depression in model 4; and all WPE factors in model 5 showed significant differences. In model 6 income, smoking, regular dental visit, and all WPE factors showed significant differences.

Table 1. The distribution of respondents according to tooth brushing after lunch (TAL) and tooth brushing before sleep (TBS) activities

Variables	Total n (column %)	Do TAL n (column %)	<i>p</i> *	Do TBS n (column %)	<i>p</i> *
Total	8,927 (100.0)	4,136(46.3)		3,951(44.3)	
Gender					
Male	4,096 (45.9)	1650 (40.3)	***	1738 (42.4)	***
Female	4,830 (54.0)	2486 (51.5)		2213 (45.8)	
Neo-Marxian social classes					
Capitalist	113 (1.7)	47 (41.6)	***	57 (50.4)	***
Small Employers	658 (9.8)	201 (30.5)		288 (43.8)	
Petty Bourgeoisie	1580 (23.6)	586 (37.1)		599 (37.9)	
Manager	114 (1.7)	63 (55.3)		48 (42.1)	
Expert Supervisor	491 (7.3)	337 (68.6)		262 (53.4)	
Skilled Supervisor	445 (6.6)	315 (70.8)		227 (51.0)	
Non-Skilled Supervisor	380 (5.7)	191 (50.3)		167 (43.9)	
Expert Worker	337 (5.0)	238 (70.6)		174 (51.6)	
Skilled Worker	455(6.8)	304(67.8)		216(47.5)	
Non-Skilled Worker	2136 (31.8)	3176 (47.3)		856 (40.0)	
Missing	2218				

*Obtained from chi-square tests. ****p* < 0.001 ***p* < 0.05

Table 2. The distributed frequency of possible mediating variables according to tooth-brushing after lunch (TAL) and tooth-brushing before sleep (TBS) activities

Variables	Number of respondent (Column%)	TAL (Column%)	<i>p</i> *	TBS (Column%)	<i>p</i> *
<i>Material factors</i>					
Income					
I (lowest)	1559 (23.5)	853(20.9)	***	579(20.3)	***
II	1619 (24.5)	915(22.4)		702(24.6)	
III	1691 (25.5)	1,127(27.6)		761(26.6)	
IV (highest)	1753 (26.5)	1,185(29.0)		814(28.5)	
House Ownership					
0	2271 (33.9)	1332(32.3)	***	1019(35.4)	
1	3750 (56.0)	2376(57.6)		1582(54.9)	
≥ 2	673 (10.0)	419(10.2)		280(9.7)	
<i>Health behaviors</i>					
Smoking					
Current	2126 (31.7)	867(21.0)	***	980(33.9)	**
Former	1267 (18.9)	695(16.8)		537(18.6)	
Never	3315 (49.4)	2574(62.2)		1375(47.5)	
Recent dental visit					
Yes	2116 (31.5)	1164(36.6)	***	966(33.4)	**
No	4593 (68.5)	2012(63.4)		1926(66.6)	
<i>Psychosocial factors</i>					
Stress					
No	4543 (67.7)	2824(68.3)		1885(65.2)	***
Yes	2165 (32.3)	1312(31.7)		1007(34.8)	
Depression					
No	5851 (87.2)	3628(87.7)	**	2517(87.0)	
Yes	857 (12.8)	508(12.3)		375(13.0)	
<i>Workplace Environment</i>					
Physical					
Very Good	2810(37.4)	1525(43.2)	***	1191(41.3)	***
Good	2025(26.9)	981(27.8)		781(27.1)	
Bad	1347(17.9)	546(15.5)		493(17.1)	
Very Bad	1339(17.8)	48(13.6)		420(14.6)	
Psychosocial					
Very Good	1659(22.2)	733(20.9)		580(20.2)	**
Good	2242(30.0)	1078(30.7)		836(29.2)	
Bad	1936(25.9)	911(25.9)		756(26.4)	
Very Bad	1634(21.9)	789(22.5)		693(24.2)	
Chemical Exposure					
Very Good	3172(42.2)	1702(48.2)	***	1289(44.7)	***
Good	1630(21.7)	774(21.9)		611(21.2)	
Bad	1135(15.1)	493(14.0)		401(13.9)	
Very Bad	1588(21.1)	564(16.0)		585(20.3)	

* chi-square test; ** <0.05; *** <0.001

The expert worker showed the highest OR of 2.40 as compared to that of non-skilled workers after full adjustment in model 6. The OR change from unadjusted value was >100% increase for capitalist, 62.4% increase for non-skilled supervisors, and 62.2% increase for manager due to all mediating factors in this model. The lowest OR change was noted for skilled supervisors (36.9%). The highest explanatory power for NMSC was

smoking (135%), followed by income and psychosocial WPE. All the factors were significant. The lowest, but significant power came from age (6.25%) and gender (66.9%).

Table 4 presents the ORs of every NMSC, and the power of explanation the mediating factors, elaborating on the relationship between the NMSC and TBS. The capitalist

showed significantly the highest probability of TBS as compared to other social classes among the different models (OR = 1.97, 1.85, 1.95, 1.92, and 1.66 in models 1–5, respectively), followed by expert workers (OR = 1.52, 1.45, 1.58, 1.50, and 1.31 in models 1–5, respectively). Among the worker groups, ORs of non-skilled was lower than that of other groups even after adjusting for all mediating factors, except for WPE factor (non-skilled supervisor had lower OR). The WPE factors were the highest explanatory power for all group positions, followed by the M factor, except for petty bourgeoisie (OHB factor).

Explaining the role of mediating factors, income in model 2, smoking and regular dental visit in model 3, stress in model 4, and WPE physical and psychosocial

factors in model 5 showed significant differences. In model 6 income, smoking, WPE physical, and psychosocial factors had significant differences.

The capitalist showed the highest OR of 1.54 as compared to non-skilled workers after full adjustment in model 6. The OR change from unadjusted value was >100% increase for non-skilled supervisor, 69.5% increase for skilled workers, and 63.5% increase for skilled supervisors due to all the mediating factors in this model. The lowest OR change was noted for the expert supervisors (40.6%). The highest and explanatory power for NMSC was gender (234%), followed by stress, income, and psychosocial WPE. Only the stress factor was insignificant. The lowest, but significant power was noted for age (4.65%) and smoking (84.2%).

Table 3. The power of explanation of possible mediating variables in the relationship between NMSC and tooth brushing after lunch (TAL)

Neo-Marxian Social Class	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6							
	OR	95% CI	ΔOR%	OR	95% CI	ΔOR%	OR	95% CI	ΔOR%	OR	95% CI	ΔOR%	OR	95% CI	ΔOR%	OR	95% CI	ΔOR%					
Capitalist	1.30	0.88	1.91	1.10	0.74	1.63	-67.46	1.32	0.89	1.96	8.47	1.30	0.88	1.93	2.71	1.08	0.72	1.60	-73.90	0.98	0.65	1.46	-108.47
Small Employers	0.69	0.57	0.83	0.62	0.51	0.76	21.61	0.71	0.59	0.86	-5.81	0.69	0.57	0.84	-1.29	0.58	0.47	0.71	36.13	0.55	0.45	0.68	44.84
Petty Bourgeoisie	0.81	0.71	0.93	0.79	0.68	0.90	13.83	0.82	0.71	0.94	-2.13	0.81	0.71	0.93	0.00	0.74	0.64	0.85	39.89	0.72	0.62	0.83	50.00
Manager	2.23	1.52	3.28	1.95	1.32	2.88	-22.93	2.10	1.42	3.09	-11.02	2.23	1.52	3.28	-0.16	1.71	1.15	2.54	-42.46	1.47	0.98	2.19	-62.16
Expert Supervisor	2.48	2.00	3.07	2.17	1.75	2.71	-20.46	2.18	1.75	2.71	-20.12	2.46	1.98	3.04	-1.42	2.07	1.66	2.57	-27.85	1.67	1.33	2.09	-54.67
Skilled Supervisor	2.84	2.26	3.57	2.67	2.12	3.36	-9.50	2.67	2.12	3.36	-9.45	2.83	2.25	3.55	-0.76	2.35	1.86	2.97	-26.60	2.16	1.70	2.74	-36.92
Non-Skilled Supervisor	1.12	0.89	1.40	1.11	0.89	1.39	-4.27	1.13	0.90	1.42	11.11	1.11	0.89	1.39	-4.27	1.02	0.82	1.28	-81.20	1.04	0.83	1.32	-62.39
Expert Worker	3.67	2.85	4.73	3.15	2.44	4.08	-19.46	3.33	2.58	4.31	-12.72	3.66	2.84	4.72	-0.34	2.94	2.27	3.81	-27.43	2.40	1.84	3.12	-47.75
Skilled Worker	3.20	2.57	3.97	2.81	2.25	3.51	-17.52	2.99	2.40	3.73	-9.42	3.18	2.56	3.96	-0.68	2.48	1.98	3.11	-32.82	2.14	1.70	2.70	-48.11
Non-Skilled Worker	Reference																						
Age	0.98	0.98	0.99	0.98	0.98	0.99	6.25	0.98	0.98	0.99	18.75	0.98	0.98	0.99	0.00	0.99	0.98	0.99	-12.50	0.98	0.98	0.99	6.25
Gender	1.87	1.68	2.08	1.86	1.67	2.08	-0.46	1.33	1.16	1.53	-61.64	1.90	1.71	2.12	4.03	1.77	1.58	1.97	-11.64	1.29	1.12	1.48	-66.94
Income			1.17	1.11	1.22	-116.60														1.13	1.07	1.19	-112.90
Housing			1.10	1.01	1.20	-109.80														1.07	0.98	1.17	-107.30
Smoking							1.36	1.26	1.47	-135.70										1.35	1.25	1.46	-135.00
Regular Dental Visit							0.71	0.63	0.79	-70.70										0.74	0.66	0.83	-73.90
Stress												0.98	0.88	1.10	-97.90					1.02	0.91	1.15	-102.20
Depression												0.81	0.70	0.95	-81.40					0.85	0.72	1.00	-85.20
Physical WPE																0.85	0.81	0.90	-85.30	0.87	0.82	0.91	-86.70
Psychosocial WPE																1.09	1.03	1.14	-108.50	1.08	1.03	1.14	-108.30
Chemical Exposure WPE																0.91	0.87	0.95	-91.00	0.92	0.87	0.96	-91.60

Baseline model (1) : age & gender adjusted

Model 2 : Baseline model + M variables (income & housing).

Model 3 : Baseline model + HB variables (smoking & recent dental visit).

Model 4 : Baseline model + PS variables (stress & depression).

Model 5 : Baseline model + WPE variables (physical, psychosocial, & chemical exposure)

Model 6 : Baseline model + all variables

Bold indicates level of significant at $p < 0.05$

Table 4. The power of explanation of possible mediating variables in the relationship between NMSC and tooth brushing before sleeping (TBS)

Neo-Marxian Social Class	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6		
	OR	95 % CI	ΔOR%	OR	95 % CI	ΔOR%	OR	95 % CI	ΔOR%	OR	95 % CI	ΔOR%	OR	95 % CI	ΔOR%	OR	95 % CI	ΔOR%
Capitalist	1.97	1.34 2.90		1.85	1.25 2.73	-12.47	1.95	1.32 2.86	-2.47	1.92 1.31 2.83	-4.95	1.66 1.13 2.46	-31.65	1.54 1.04 2.29	-44.02			
Small Employers	1.32	1.10 1.58		1.29	1.07 1.55	-9.35	1.32	1.10 1.59	0.62	1.30 1.09 1.56	-5.92	1.19 0.98 1.43	-41.74	1.16 0.96 1.41	-50.16			
Petty Bourgeoisie	1.08	0.94 1.24		1.09	0.95 1.25	18.42	1.11	0.96 1.27	40.79	1.08 0.94 1.24	0.00	1.00 0.87 1.16	-98.68	1.04 0.90 1.21	-42.11			
Manager	1.32	0.90 1.95		1.28	0.86 1.89	-13.71	1.34	0.90 1.98	4.67	1.31 0.89 1.93	-4.67	1.15 0.77 1.72	-52.96	1.13 0.76 1.69	-58.88			
Expert	1.37	1.12 1.68		1.30	1.06 1.61	-17.71	1.42	1.16 1.75	14.99	1.37 1.12 1.68	0.54	1.21 0.98 1.49	-41.96	1.22 0.98 1.51	-40.60			
Supervisor																		
Skilled	1.17	0.95 1.45		1.14	0.92 1.41	-20.00	1.20	0.97 1.49	18.24	1.17 0.94 1.44	-1.18	1.07 0.86 1.32	-61.18	1.06 0.85 1.32	-63.53			
Supervisor																		
Non-Skilled	1.00	0.80 1.26		1.01	0.80 1.27	800.00	1.02	0.81 1.28	1700.00	1.01 0.80 1.27	600.00	0.97 0.77 1.22	-3400.00	0.99 0.78 1.25	-1200.00			
Supervisor																		
Expert Worker	1.52	1.20 1.92		1.45	1.14 1.85	-12.88	1.58	1.24 2.00	10.58	1.50 1.19 1.90	-3.65	1.31 1.03 1.67	-40.77	1.30 1.02 1.67	-41.54			
Skilled Worker	1.26	1.03 1.55		1.22	0.99 1.51	-15.27	1.28	1.04 1.58	6.49	1.25 1.02 1.54	-4.58	1.10 0.88 1.36	-63.36	1.08 0.87 1.35	-69.47			
Non-Skilled																		
Worker																		
Age	0.96	0.95 0.96		0.96	0.95 0.96	0.00	0.96	0.95 0.96	-2.33	0.96 0.95 0.96	-2.33	0.96 0.95 0.96	-2.33	0.96 0.95 0.97	-4.65			
Gender	1.09	0.98 1.21		1.10	0.99 1.22	9.09	1.32	1.15 1.51	264.77	1.08 0.97 1.20	-11.36	1.07 0.96 1.19	-25.00	1.29 1.13 1.49	234.09			
Income				1.09	1.04 1.14	-109.00								1.08 1.03 1.13	-107.90			
Housing				0.93	0.86 1.01	-93.30								0.94 0.87 1.03	-94.40			
Smoking							0.84	0.78 0.91	-84.30					0.84 0.78 0.91	-84.20			
Regular Dental Visit							0.88	0.79 0.98	-88.30					0.91 0.82 1.02	-91.20			
Stress										1.12 1.00 1.25	-111.80			1.10 0.98 1.24	-110.30			
Depression										1.04 0.89 1.21	-103.50			1.02 0.87 1.20	-102.00			
Physical WPE													0.88 0.84 0.93	-88.30	0.89 0.84 0.93	-88.80		
Psychosocial WPE													1.10 1.04 1.15	-109.60	1.08 1.03 1.14	-107.90		
Chemical Exposure WPE													0.99 0.94 1.04	-98.90	0.98 0.94 1.03	-98.10		

Baseline model (1) : age & gender adjusted

Model 2 : Baseline model + M variables (income & housing)

Model 3 : Baseline model + HB variables (smoking & recent dental visit)

Model 4 : Baseline model + PS variables (stress & depression)

Model 5 : Baseline model + WPE variables (physical, psychosocial, & chemical exposure)

Model 6 : Baseline model + all variables

Bold indicates level of significant at $p < 0.05$

Discussion

There is an inequality in oral health behavior among the social classes, although the gradient is not clearly visible. In this study, the proportion of TAL and TBS was higher in women than in men. This finding was comparatively similar to that of studies on Japanese¹¹ and Greek¹² adults as well as Scottish teenagers,¹³ wherein the proportion of female subjects who brushed their teeth almost every day was larger than that of male subjects. This seemed to be a common finding across countries.

Considering the criteria of participants in this study, we assumed that TAL was performed mostly at workplace, while TBS was performed mostly at home. The findings in Table 3 may be an indication of “time poverty” experienced by small employers as well as the petty bourgeoisie. Based on a framework to analyze time use and time poverty, as proposed by Kes and Swaminathan¹⁴, the

groups of small employers and petty bourgeoisie seemed to be involved in both productive and reproductive works. They were clearly property owners; however, their activities were more than those of workers. They might spend more time in performing the committed activities, which may result in the lack of time for other necessary activities. Previous study mentioned the possibility that poor-time individuals have poor health behaviors¹⁵ as well as other study reported that rushing time was associated with poor mental health¹⁶, which might explain the lower ORs of small employers and the petty bourgeoisie as compared to those of non-skilled workers in TAL.

For TBS, other social classes showed higher probability than non-skilled workers. The highest OR belonged to capitalist, the first ownership position in all models. It was slightly different from a finding in Spain that mentioned manager groups were the highest, referring to

a health indicator.¹⁷ This finding may indicate “time poverty” faced by non-skilled workers. Considering the definition that “necessary activities are those activities that must be performed by an individual for himself or herself (such as sleeping, grooming, health-related self-care, and other personal and/or private activities)¹⁵, tooth brushing activities could be included in these activities. As expected, TBS was a home-based habitual, and non-skilled workers did not find sufficient time to TBS.

Related to these findings, some studies also revealed that oral health behaviors are associated with the socioeconomic status. A study conducted among British adults suggested that individuals from the lower socioeconomic positions tend to have a higher degree of clustering of multiple risk factors for poor dental hygiene.¹⁸ Among Norwegian adults, individuals from higher occupational position had higher quality of life related oral health status.¹⁹ A study among the Korean population also revealed a significant gradient among the income and education groups for tooth brushing activities.²⁰ This difference may be influenced by the differences in the socioeconomic indicators used and the different data sources. Other studies used a single indicator or separate indicators, while this study combined several socioeconomic indicators. The combination of several indicators could identify the vulnerable groups of oral health issues that may be missed by a single or separate indicators.

Workplace-based oral health promotion programs should be aimed across all social classes. The tooth brushing behavior needed attention since some studies have reported the relationship between TBS^{21,22} and TAL²³ with dental caries. At the implementation level, “more risk/vulnerable” groups, such as non-skilled workers, non-skilled supervisors, and petty bourgeoisie should be given more emphasis. At the implementation level, there could be the possibility of applying the idea of the common risk factor approach (CRFA)²⁴ to make implementation more holistic including various determinants.

The limitations and strengths of this study should be included in its interpretation. Because of the cross-sectional design of this study, the direction of causality could not be disclosed. Another limitation is that the number of samples was insufficient for each of the 12 social classes. Consequently, the managers were combined and analyzed as one group without distinguishing educational assets.

There are 2218 missing data due to the unavailability of one or more components to make up NMSC. As stated that NMSC consists of several components and if one of the components that make up NMSC is not available, the respondent is excluded from NMSC.

This study proposes a non-conventional method by not separating analysis between male and female groups as is commonly applied in studies using NMSC. Moreover, this study will add to the number of studies on NMSC and oral health behaviors that may not be available or still very few.

Conclusions

Inequalities were noted in oral health behaviors (TAL and TBS) among the social classes of the South Korean population, although the gradient was not visible. The behavior of brushing teeth at two different times showed a different pattern of social inequality regarding oral health. Therefore, workplace-based oral health promotion integrated programs should be proposed for all social classes considering the CRFA.

Acknowledgments

The authors wish to express their special appreciation to all the examiners and the participants in KNHANES and also to the editors and anonymous reviewers whose suggestions made this manuscript much improved.

Funding

This article is sponsored by LPDP (Indonesia Endowment Fund for Education) through awardee no: 20151222084948.

Conflict of Interest Statement

None of the authors have a conflict of interest in relation to this study.

Received: November 8, 2018 Accepted: February 21, 2019

References

1. Holstein BE, Bast LS, Brixval CS, Damsgaard MT. Trends in social inequality in tooth brushing among adolescents: 1991–2014. *Caries Res.* 2015;49:595–9.
2. Safiri S, Kelishadi R, Heshmat R, Rahimi A, Djalalinia S, Ghasemian A, *et al.* Socioeconomic inequality in oral health behavior in Iranian children and adolescents by the Oaxaca-Blinder decomposition method: the CASPIAN-IV study. *Int J Equity Health.* 2016;15:143.
3. Muntaner C, Ng E, Chung H, Prins SJ. Two decades of Neo-Marxist class analysis and health inequalities: A critical reconstruction. *Soc Theory Health.* 2015;13:267–87.
4. Novrinda H, Han D-H, Jung-Choi K, Ryu J-I. Neo-Marxian social class inequalities in oral health among the South Korean population. *Commun Dent Oral Epidemiol.* 2019;47:162–70.
5. Wright EO. *Class counts: Comparative studies in class analysis*: Cambridge University Press; 1997.
6. Thomson WM. Social inequality in oral health. *Commun Dent Oral Epidemiol.* 2012;40:28–32.

7. Kim KW. The percentage of adolescents who brush their teeth after lunch and its related factors. *J Korean Society Hyg.* 2010;10:441–8.
8. Sabbah W, Tsakos G, Sheiham A, Watt RG. The role of health-related behaviors in the socioeconomic disparities in oral health. *Soc Sci Med.* 2009;68:298–303.
9. Oh MG, Han MA, Park J, Ryu SY, Park CY, Choi SW. Health behaviors of cancer survivors: the fourth Korea national health and nutrition examination survey (KNHANES IV, 2007–09). *Japan J Clin Oncol.* 2013;43:981–7.
10. Richiardi L, Bellocco R, Zugna D. Mediation analysis in epidemiology: methods, interpretation and bias. *Int J Epidemiol.* 2013;42:1511–9.
11. Furuta M, Ekuni D, Irie K, Azuma T, Tomofuji T, Ogura T, *et al.* Sex differences in gingivitis relate to interaction of oral health behaviors in young people. *J Periodontol.* 2011;82:558–65.
12. Mamai-Homata E, Koletsi-Kounari H, Margaritis V. Gender differences in oral health status and behavior of Greek dental students: A meta-analysis of 1981, 2000, and 2010 data. *J Inter Soc Preventive Comm Dent.* 2016;6:60–8.
13. Levin KA, Currie C. Inequalities in toothbrushing among adolescents in Scotland 1998–2006. *Health Educ Res* 2009;24:87–97.
14. Kes A, Swaminathan H. *Gender, Time Use, and Poverty in Sub-Saharan Africa.* In: Blackden CM, Wodon Q, editors. Working Paper 73. Washington, DC: World Bank; 2006. pp. 13–8.
15. Kalenkoski CM, Hamrick KS. How does time poverty affect behavior? A look at eating and physical activity. *Appl Econ Perspect Polic.* 2012;35:89–105.
16. Strazdins L, Welsh J, Korda R, Broom D, Paolucci F. Not all hours are equal: Could time be a social determinant of health? *Soc Health Illness.* 2016;38:21–42.
17. Muntaner C, Borrell C, Benach J, Paserin MI, Fernandez E. The associations of social class and social stratification with patterns of general and mental health in a Spanish population. *Int J Epidemiol.* 2003;32.
18. Singh A, Rouxel P, Watt RG, Tsakos G. Social inequalities in clustering of oral health related behaviors in a national sample of British adults. *Prev Med.* 2013;57:102–6.
19. Astrom AN, Wold B. Socio-behavioural predictors of young adults' self-reported oral health: 15 years of follow-up in the The Norwegian longitudinal health behaviour study. *Community Dent Oral Epidemiol.* 2012;40:210–20.
20. Park J-B, Han K, Park Y-G, Ko Y. Association between socioeconomic status and oral health behaviors: The 2008–2010 Korea national health and nutrition examination survey. *Exp Ther Med.* 2016;12:2657–64.
21. Molina-Frechero N, Pierdant-Rodríguez AI, Oropeza-Oropeza A, Bologna-Molina R. Fluorosis and dental caries: An assessment of risk factors in Mexican children. *Revista de Investigacion Clinica.* 2012;64:67–73.
22. Nakano K, Okawa R, Miyamoto E, Fujita K, Nomura R, Ooshima T. Tooth brushing and dietary habits associated with dental caries experience: Analysis of questionnaire given at recall examination. *Pediatric Dent J.* 2008;18:74–7.
23. Takayanagi A, Endoh M. Effect of “Campaign for tooth brushing after lunch” at junior high schools using a fluoride toothpaste on the prevention of dental caries. *Health Sci Health Care.* 2014;14:66–9
24. Watt RG, Sheiham A. Integrating the common risk factor approach into a social determinants framework. *Commun Dent Oral Epidemiol.* 2012;40:289–96.